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Abstract

NUCLEAR GRADE ZIRCONIUM FROM EGYPTIAN ZIRCON

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The manufacture of cladding zircalloys implies starting with 98% ore and silica-free zirconia before dehafnization and metallurgical elaboration.

In a previous work(*) the preparation of high purity zirconia - containing only 0.04% silica, trace iron and titanium from unground placers by soda sintering - was described.

The present investigation resumes dehafnization study of the fed zirconia still containing 1.4% HfO_2. The usual organophosphorus and amine solvents were re-examined in view of enhancing maximum loading charge and introducing cheaper commercial varieties. Tributylphosphate as 60% solution is suggested after thorough examination of numerous diluents besides white spirit. The efficiency of diluents follows the order: odourless kerosene methyl isobutyl ketone > xylol > n-hexane > benzene > cyclohexane > toluene. Examined variables included: time of contacting (1-5 minutes), concentration of free nitric acid (5-8 molar), of fed zirconium (5-100 gm Zr/litre), saltingout agents (about 3.5 molar nitrates). For diluted aqueous feed: 10 gm Zr/litre, the added cations enhanced separation in the order: Al > Mg > Li > Na > NH_4 - nitrates. Optimals were reached after two minutes contacting time and using 6.5M free nitric acid. The maximum loading charge (80 gm/litre) compared favourably with values obtained in the competitive thiocyanate-hexone refining process, although the separation factor obtained in the present study approximates three-fold that of the

(*) M.Y. Farah and S.I. El-Yamani: "The Alkali Sintering of Egyptian Zircon Placers".

German process signifying its feasibility on smaller mixer-settler batteries.

In the examination of long-chain aliphatic and aromatic amines, the latter were found to give in general better results than the former and the tertiary were more favourable than the secondary and still more than the primary ones. Amines examined included: Armeen C,S,T, TD, HTD of Armour Hess and FB-Amine 10, 12, 16, 17, 18 of Float-Ore firm. Tri- and dibenzylamine and trilaurylamine hydrochlorides as well as sulphate liquors were studied and the effect of lowering temperature, increasing acidity and changing diluents were examined as for TBP runs.

Optimal results were obtained with tribenzylamine while cooling and equally good but slightly lower results were encountered with the cheaper commercial amines in general justifying their applicability as effective competitive solvents for TBP owing to still higher separation factors.

Isotherms were drawn based on analyses of both phases for Zr by EDTA Bi back titration and for Hf using tracer Hf^{181}.